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Some Aspects on the Feeding of *Gerres oblongus* (Cuvier, 1830) Dwelling from the Jaffna lagoon

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Abstract: A total of 179 fishes of *Gerres oblongus* (Cuvier, 1830) ranging in standard length 40 to 169 mm were collected in the morning from four collection sites in the Jaffna lagoon. The stomach contents were assessed qualitatively and quantitatively. The fishes were placed in 19 mm size class intervals and the food analysis were done both by qualitatively and quantitatively. Variation of food with respect to month was also determined. The analysis of gut contents of *G. oblongus* showed that it is an omnivore and the preference to animal diet is higher than the vegetable matter. The presence of molluscs, soil particles and polychaetes indicated that it is a substratum feeder or feed largely on attached surfaces. Feeding intensity was high during February which has been reflected by the satiation index (8.3) in the same period. At the same time coefficient of condition has been fluctuated in between 2.2-3.7 except in May (4.4) indicated that it has slow growth rate. The mean relative gut length showed a positive increase with the body length. The value for the relationship between the mean relative gut length to body length further confirms that it is omnivorous in feeding habit.

Key words: *Gerres oblongus*, omnivore, satiation index, polychaetes, growth rate

INTRODUCTION

Gerres oblongus is a high consumer demanded and economically sound fish species with high market value that can grow up to 300 mm in total length (De Bruin *et al.*, 1994). Though FAO (Food and Agriculture Organization) identified *G. oblongus* (Pisces: Perciformes: Gerreidae) as a rare species in Sri Lanka, it is one of the common fish species caught in the Jaffna lagoon along with a number of other fishes. *G. oblongus* (Cuvier, 1830) is one of the two species of Gerreids recorded along the coastal areas and brackish water bodies in the Northern part of Sri Lanka (Sivashanthini and Abeyrami, 2003). These fishes were collected from the commercial catches of a fishing net called sirahuvalai or kalankatti or kalankanni which is fixed at night in shallow water areas down to the depth that starts from 6 feet with the mesh size of 11-13 mm. The knowledge of the feeding habits of fish is important especially when it has high consumer demand. This will help cultivators to grow fish efficiently and profitably. In addition to this, the demand for animal protein for increasing world population could be provided by culturing fish artificially.

The Jaffna lagoon is a shallow water body located in the Northern Province of Sri Lanka. The Jaffna lagoon lies approximately 79°52' E to 80°38' E long., 9°26' N to 9°46' N lat. and has an area of about 412 km^2. The lagoon is extended as a narrow body of water separating the Jaffna Peninsula from main land and a few neibouring islands (Somasekaram, 1997).

Table 1: Age, standard length and No. of *G. oblongus* examined from five fish markets

Age	Standard length	No. of fish examined
0+	40-59	11
1+	60-79	16
2+	80-99	32
3+	100-119	31
4+	120-139	47
5+	140-159	23
6+	160-179	19
Total		179

The present investigation was designed to figure out the feeding habit of silver-biddy *G. oblongus* inhabiting the Jaffna lagoon. This includes the percentage composition of food and its variation with regard to the size of fish. For the purpose of specifying feeding preferences, the sizes of fish were categorized with regards to the standard length (Table 1). Here *G. oblongus* with standard length ranging from 40 to 179 mm placed in 19 mm class intervals were analyzed.

MATERIALS AND METHODS

Random monthly samples of fishes from 2004 November to 2005 October were obtained from four fish landing centers (Fig. 1) from the commercial catches were

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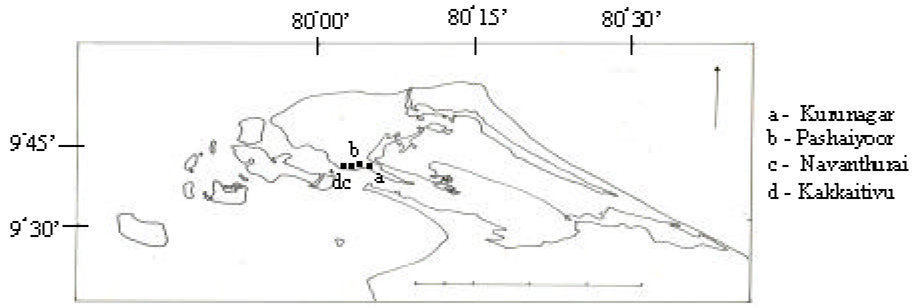

Fig. 1: Map of the study area showing the collection sites

brought to the laboratory and the whole gut was removed. The fish were weighed to the nearest 1.0 g and the total length of fish was weighed to the nearest 1.0 mm. The gut was uncoiled, cleared off adhering fats and its length and weight were also taken. The contents of the entire gut were assessed qualitatively and quantitatively. The food species present were identified as far as possible. Each time the total and standard lengths were also taken. The data gathered were analyzed by the following way.

In the qualitative analysis, the fullness of stomach was assessed into empty, trace to 25%, 25-50% and more than 50%. Quantitative analysis comprised into percentage occurrence method and the number or numerical abundance method. The occurrence method accounts the total number of fishes containing a particular food item (Allen, 1935; Balik *et al*., 2006; Bhuiyan *et al*., 2006; De Silva *et al*., 1977; de Melo *et al*., 2004; Frost, 1939, 1946; Fagade and Olaniyan, 1973; Frost and Went, 1940; Hartley, 1940, 1947, 1948; Hyslop, 1980; Ikusemiju and Olaniyan, 1977; Jensen, 1980; Lal Mohan, 1985; Wahbeh and Ajiad, 1985). Often the number of occurrence of all items is summed and scaled down to a percentage basis to show the percentage composition of the diet (Hynes, 1950). Where as the numerical abundance method considers the total number of food items present in the total number of fishes examined (Allen, 1938, 1941; Carpenter, 1940; De Silva *et al*., 1977; Fagade and Olaniyan, 1973; Frost, 1939, 1946; Frost and Went, 1940; Hynes, 1950; Mariano- Jelicich *et al*., 2003; Neill, 1938; Radforth, 1940; Ikusemiju and Olaniyan, 1977; Oso *et al*., 2006).

To determine the degree of satiation or index of fullness (Spataru, 1978), the following formula was used:

$$\text{Index of fullness} = (w/W) \times 100$$

where, w is the weight of the gut contents and W is the weight of the fish. The quantitative utilization of the trophic basis by the fish is represented by the condition of the fish, hence the coefficient of the condition (Beckman, 1948) was calculated by the following formula:

$$\text{Coefficient of condition} = W \times 10^5 / L^3$$

where, L is the length of the fish W is the weight of the fish.

RESULTS AND DISCUSSION

A total of 179 specimens of *G. oblongus* (standard length 40-199 mm) were examined of which 39 (22%) were with empty stomachs. Food in the stomachs formed between 0.49 to 7.38% of the body weight. Of the 179 fishes examined, 140 had undigested gut contents. A summary of the food items is shown in Table 2 and in Fig. 2A.

The composition of the diet of *G. oblongus* revealed 45.73% molluscs, 27.23% crustaceans, 11.67% sand particles, 5.95% algal filaments and 5.52% macrophytes in the numerical abundance basis. These values have been changed to 74% (134 fishes), 78% (140 fishes) and 57% (102 fishes), 44% (78 fishes) and 61% (109 fishes) for molluscs, crustaceans, sand, algal filaments and macrophytes, respectively in the occurrence method (Fig. 2A, Table 2).

Of the 140 specimens with food, 18 fishes (10.05%) had unidentified particles in their stomachs. The results show that molluscs were the important food when using the numerical abundance method and crustaceans were the dominant by the occurrence method than any other constituents in the diet composition. The food items of the gut were found to be both animal and plant matters, of which the plant matters fall into algal filaments, diatoms and macrophytes; while the animal matters categorized into crustaceans, bivalves, molluscs, polychaetes and sand.

As far as plant materials are concerned, smaller fish ranging in standard length from 40-99 mm feed largely on planktonic vegetations such as blue green algae, green algae and diatoms while macrophytes (*Thallasia*) become the preferred food from 80 mm and above (Fig. 2B). As far as the animal materials are concerned, the animal matters were also changed from planktonic forms (cladocerans

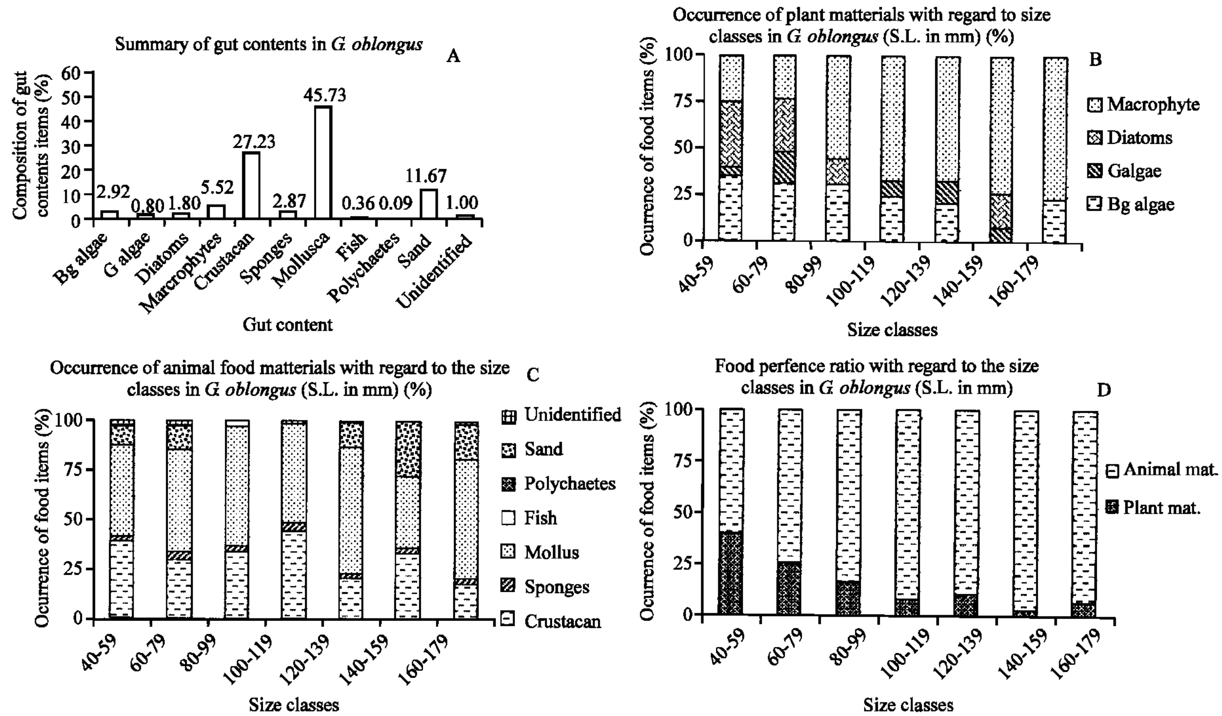

Fig. 2: Summary of gut contents (A), food preference of plant materials (B), food preference of animal materials (C) and the ratio of plant and animal materials (D) present in the gut of *G. oblongus* with reference to the size classes from 2004 November to 2005 October

Table 2: Analysis of gut contents of *G. oblongus* from Jaffna lagoon assessed by the two methods (% occurrence and numerical abundance methods)

	Methods of assessment			
Species name	Occurrence method		Number method	
G. oblongus				
No. of fish examined 179	No.	(%)	No.	(%)
Algal filaments	78	43.58	2670	5.95
Blue green algae			1310	2.92
Green algae			360	3.03
Diatoms	55	30.73	809	1.80
Macrophytes	109	60.89	2480	5.52
Crustaceans	140	78.21	12225	27.23
Larval crustaceans			6948	15.48
Copepods			4757	10.60
Higher crustaceans			620	1.38
Sponge (spicules)	76	42.46	1290	2.87
Molluscs	134	74.86	20530	45.73
Gastropods			7460	16.62
Bivalves			13070	29.12
Fish	19	10.61	160	0.36
Polychaete	40	28.57	40	0.09
Sand	102	56.98	5237	11.67
Unidentified particles	18	10.05	449	1.01

and planktonic crustaceans) to higher crustaceans (*Gammarus*) and mollsucs (gastropods and bivalves) while sponges have been invariably eaten by all length groups but to a lesser extent (Fig. 2C). It was observed that tube dwelling polychaete worms were found in the stomach of fishes with lengths 120 mm and above (Fig. 2C). The presence of sand particles and molluscs invariably found in the stomach of almost all fishes indicated that it feeds largely on attached surfaces and crevices or on substratum. Also it is an evident for the usage of the protractile mouth structure of the fish. Further more it is obvious that the fish much prefer animal materials over plant materials in all length groups (Fig. 2D).

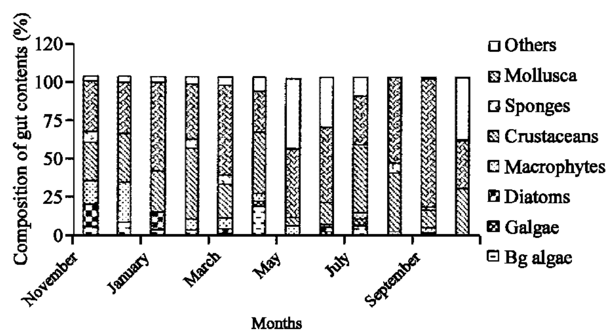

Fig. 3: Monthly variation of gut contents of *G. oblongus* from 2004 November to 2005 October

Though there was no qualitative difference in the food, monthly variation was observed in the gut contents (Fig. 3). Molluscs and crustaceans were the major food

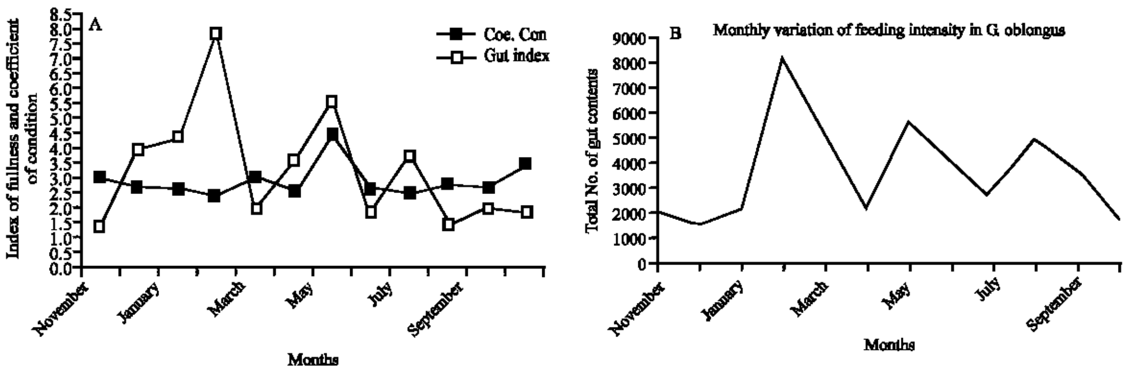

Fig. 4: (A) Monthly variation of gut index, mean coefficient of condition and (B) feeding intensity of *G. oblongus* from 2004 November to 2005 October

item over the other constituents throughout the year, but molluscs were the dominant food during January, March, June, August and September and approximately equal with the latter in the months from October to December. Crustaceans were the major item in February, April and July while polychaetes were seen only in May and August. Blue green algae, green algae and diatoms were the maximum in April, July and November respectively. Macrophytes were seen in all except January and October and sponges were seen in November, February, March, August and September.

The present investigation is in acceptance with the work carried out by Cyrus and Blaber (1983) that *G. oblongus* mainly prey on polychaetes and calanoid copepods along the Natal coast. Cyrus and Blaber (1983) also stated that the high energy value of the whole bivalves suggested that they may be the most important food item taken by many Gerreidae in other parts of the world. Present research recorded polychaete worms in 40 fishes (29%) and crustaceans including copepods in 140 fishes (78%) (Table 2). In addition to that, 134 fishes (75%) contained molluscs in their stomach contents (Table 2). Moreover Chacko (1949) stated that aquatic macrophytes were the major component of the diet of three species of *Gerres* in the Gulf of Mannar, India and macrophytes were reported as one of the dietary elements in the Gerreidae (Cyrus and Blaber, 1983). This is true that 109 fishes (61%) had macrophytes in their stomachs (Table 2) and by acting as a major component in the plant matters as far as the percentage occurrence method is concerned (Fig. 2B).

The mean coefficient of condition decreased from December to February (2.6, 2.5 and 2.3) and gets fluctuated from March to May (2.9, 2.5 and 4.4) again with low values in June, July and September (2.5, 2.4 and 2.5) (Fig. 4A). The low values of coefficient of condition (2.3-2.5) observed in January, February, April, July and September have indirectly pointed out its breeding season. This is in agreement with the results obtained for *G. oblongus*, as the spawning period of *G. oblongus* collected from the Jaffna lagoon falls between February to June for females and February, May and September for males because of the low relative condition values observed in this fish (Sivashanthini and Abeyrami, 2003). In view of overall food composition of *G. oblongus*, it has been confirmed that the fish is omnivorous in habit.

An attempt to relate the feeding pattern with season of the year showed that feeding was high in post monsoon (January to March), fluctuating in pre monsoon (April to September) and very low during the monsoon (October to December) (Fig. 4B). Higher the feeding in turn reflects the high numbers of stomach contents. Hence the high values of the satiation index or the index of fullness observed in January, February and May (4.49, 7.72 and 5.53) (Fig. 4A), because of the high feeding intensity (8307, 5120 and 5663) (Fig. 4B) indicate its voracity of feeding in these months. It can be reasonably assumed that the high values of satiation index during this months further confirms the breeding period. However the fluctuation in the intensity of feeding can be explained by the prey stock, as feeding is probably governed by the availability of suitable food at any time of the year (Fagade and Olaniyan, 1973); at the same time Arnott and Pihl (2000) discussed that the intensity of feeding can be correlated with the effect of available foraging time, prey species abundance and patchiness, species specific satiation levels and digestion rates.

Seasonal variation of the coefficient of condition reflects the growth of the fish in relation to the feeding conditions in its environment. The high value of mean coefficient of condition ranging between 2.3×10^{3} and 4.4×10^{3} can be considered in connection with the pace of growth is contradictory to the low values of the satiation index (Fig. 4A). This suggests that with the low quantities of food, the fish retained a good condition; hence it is a suitable candidate for culture.

Of the 141 fish with undigested food, forty seven showed trace to 25%; fifty eight with 25 to 50% and thirty six had more than 50% of fullness of gut suggested that the fish is a daytime feeder, as the fishes have been collected at dawn and have been brought to the market at early morning in each day. A perfect conclusion can be drawn if the fish samples collected both in the morning and the evening.

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